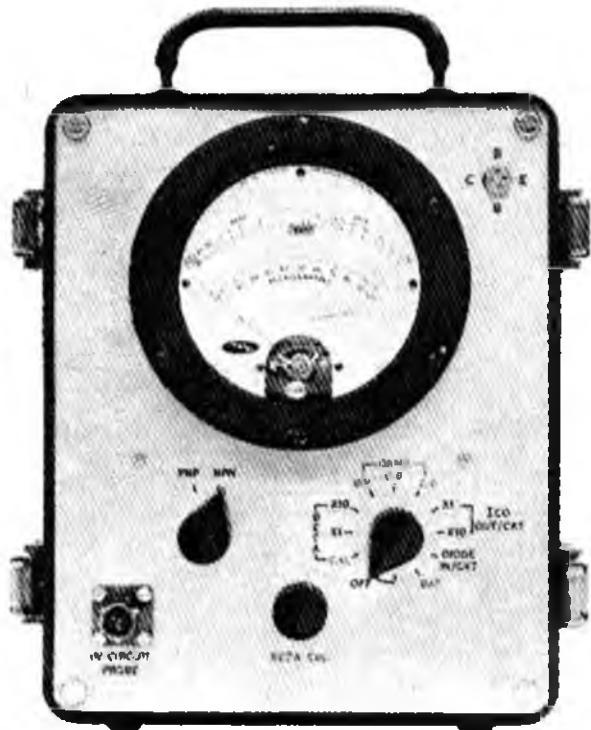


IN-CIRCUIT
SEMICONDUCTOR
TESTER
MODEL 245MA

TECHNICAL MANUAL



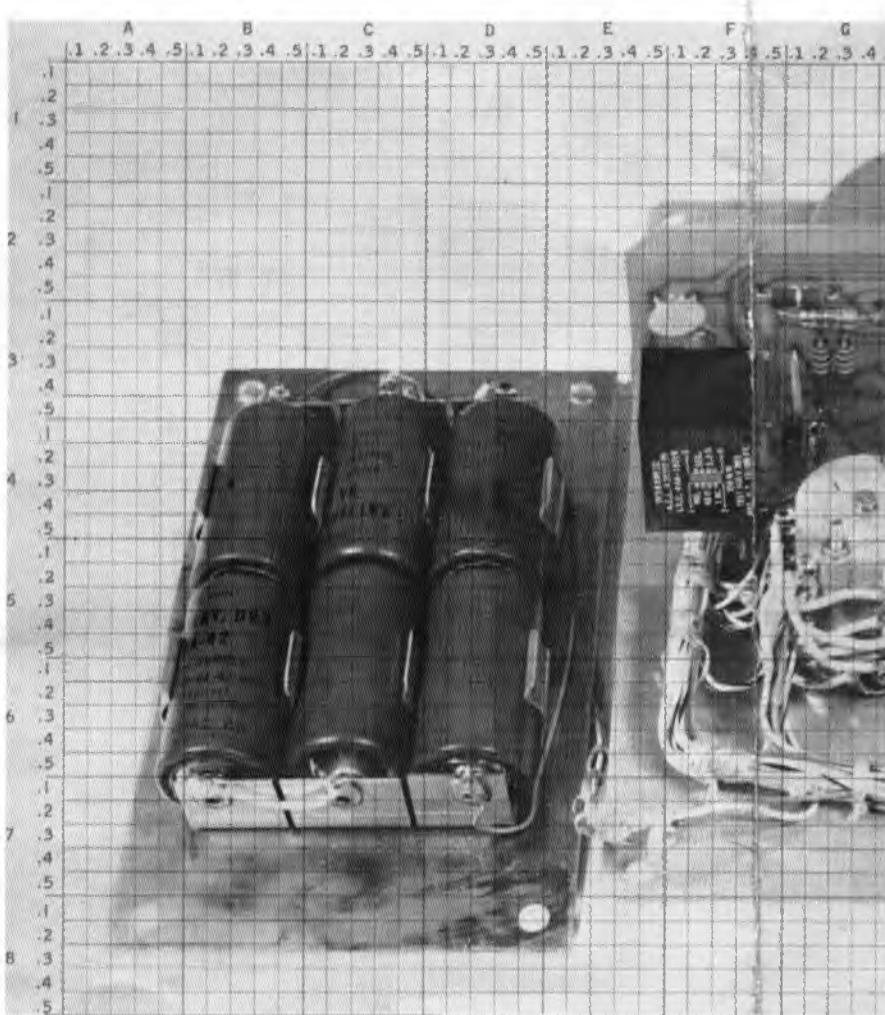
AMERICAN ELECTRONIC LABORATORIES, INC.

OPERATING INSTRUCTIONS					
S2 PNP/NPN SWITCH	SI FUNCTION POS.	ACTIONS AND INDICATIONS		EQUIVALENT CIRCUITS	
—	OFF	1	METER POINTER INDICATES EXACTLY ZERO (A) WHEN METER IS NOT IN USE. SI SHOULD ALWAYS BE 'OFF' TO AVOID UNNECESSARY DRAIN ON METER BATTERIES.		
BETA MEASUREMENTS (IN/OUT OF CIRCUIT)					
CORRESPONDS TO TYPE OF DEVICE UNDER TEST (DUT)	BETA CAL	2	PLUG TRANSISTOR IN TEST JACK, CBE (TRANSISTOR SOCKET J2); OR CONNECT TEST LEADS TO TRANSISTOR WITH YELLOW TO EMITTER, BLACK TO BASE AND RED TO COLLECTOR. ADJUST 'BETA CAL' CONTROL, R5, SO THAT METER INDICATES FULL SCALE.		
	BETA X1	3	METER INDICATES BETA DIRECTLY ON TOP SCALE. IF METER INDICATES BETA IS GREATER THAN 10, PLACE FUNCTION SWITCH SI IN THE 'BETA X10' POSITION. (SEE NOTE)		
	BETA X10	4	MULTIPLY THE METER INDICATION OF BETA BY 10 TO OBTAIN BETA. (SEE NOTE)		
ELECTRODE RESISTANCE MEASUREMENTS (IN CIRCUIT)					
—	OHMS E-B	5	CONNECT TEST LEADS TO TRANSISTOR IN CIRCUIT WITH YELLOW TO EMITTER, BLACK TO BASE, AND RED TO COLLECTOR. RESISTANCE APPEARING BETWEEN Emitter AND Base ELECTRODES IS INDICATED ON THE CENTER (RED) SCALE OF THE METER.		
	OHMS C-B	6	RESISTANCE APPEARING BETWEEN COLLECTOR AND BASE ELECTRODES IS INDICATED ON THE CENTER (RED) SCALE OF THE METER.		
	OHMS C-E	7	RESISTANCE APPEARING BETWEEN COLLECTOR AND Emitter ELECTRODES IS INDICATED ON THE CENTER (RED) SCALE OF THE METER.		
I _{CO} MEASUREMENTS (OUT OF CIRCUIT)					
CORRESPONDS TO TYPE OF DEVICE UNDER TEST (DUT)	I _{CO} OUT/CKT X1	8	PLUG TRANSISTOR IN TEST JACK, J2. METER INDICATES I _{CO} DIRECTLY IN MICROAMPERES ON LOWEST SCALE. IF METER INDICATES OFF SCALE, PLACE FUNCTION SWITCH, SI, IN THE X10 POSITION.		
	I _{CO} OUT/CKT X10	9	MULTIPLY THE METER INDICATION OF I _{CO} BY 10 TO OBTAIN I _{CO} . IF METER INDICATES OFF SCALE, REVERSE PNP/NPN SWITCH AND REPEAT POS. 8 TEST.		
DIODE IR MEASUREMENTS (OUT OF CIRCUIT)					
PNP	I _{CO} OUT/CKT X1	8	CONNECT CATHODE OF DIODE TO RED TEST LEAD, AND ANODE OF DIODE TO BLACK TEST LEAD. METER INDICATES IR DIRECTLY IN MICROAMPERES ON LOWEST SCALE. IF METER INDICATES OFF SCALE, PLACE FUNCTION SWITCH, SI, IN THE X10 POSITION.		
	I _{CO} OUT/CKT X10	9	MULTIPLY THE METER INDICATION OF IR BY 10 TO OBTAIN IR. IF METER INDICATES OFF SCALE, REVERSE PNP/NPN SWITCH AND REPEAT POS. 8 TEST.		
DIODE IN CIRCUIT MEASUREMENTS					
PNP	DIODE IN/CKT	10	CONNECT CATHODE OF DIODE TO RED TEST LEAD, AND ANODE OF DIODE TO YELLOW TEST LEAD, INCREASE 'BETA CAL' CONTROL UNTIL METER DEFLECTS UPSCALE. REVERSE PNP/NPN SWITCH IF METER DEFLECTS DOWNSCALE. NO DEFLECTION OF METER INDICATES THAT THE DIODE IS EITHER OPENED OR SHORTED, OR THAT THE RELATED CIRCUIT IMPEDANCE IS LESS THAN 20 OHMS.		
BATTERY CHECK					
—	BAT	11	IF BATTERIES ARE GOOD, METER INDICATES IN THE RED BOX LABELED 'BAT'.		

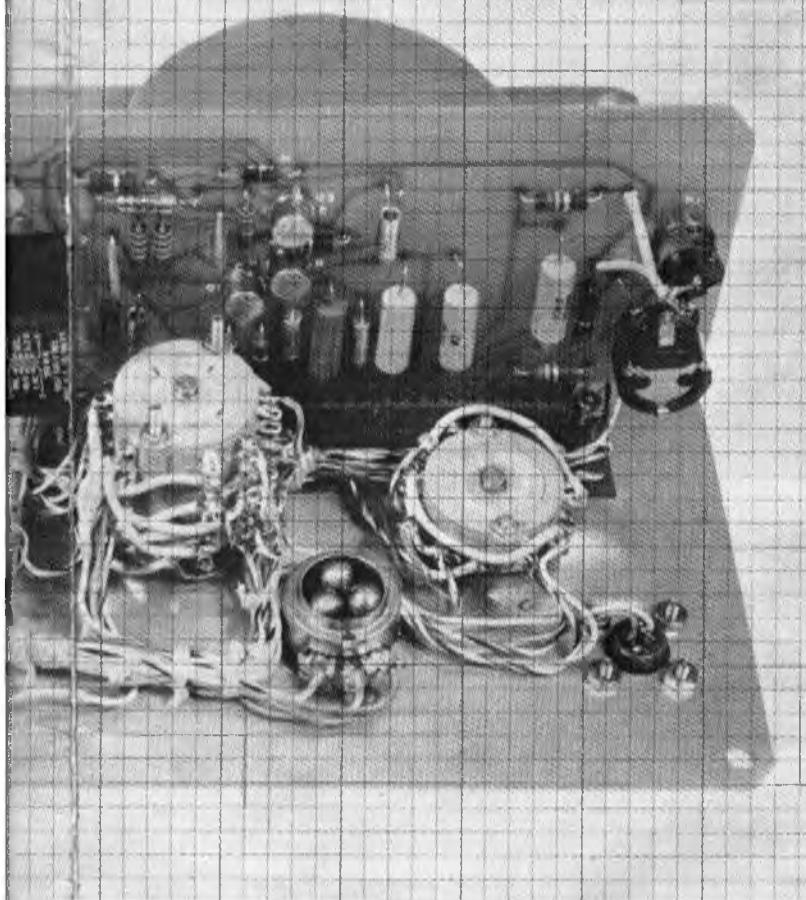
NOTE POSITIONS 5, 6 AND 7 ARE USED TO PRECLUDE FALSE INTERPRETATIONS OF IN CIRCUIT BETA MEASUREMENTS, SINCE ACCURACY OF THE BETA X 1 RANGE IS $\pm 10\%$ ONLY WHEN E TO B LOADING IS EQUAL TO OR GREATER THAN 50 OHMS. BETA X 10 IS $\pm 10\%$ ONLY WHEN E TO B LOADING IS EQUAL TO OR GREATER THAN 500 OHMS

ALIGNMENT PROCEDURE		
STEP 1	FUNCTION SWITCH S1 IN 'OFF' POSITION	ADJUST METER ADJUST SCREW ON FRONT OF METER SO THAT METER POINTER INDICATES EXACTLY ZERO.
STEP 2	_____	INSERT A 100 OHM +1% RESISTOR BETWEEN THE C-B SOCKETS OF TRANSISTOR TEST JACK ON FRONT PANEL.
STEP 3	FUNCTION SWITCH S1 IN 'OHMS E-B' POSITION	ADJUST R11 SO THAT METER INDICATES EXACTLY FULL SCALE . (INFINITY OHMS).
STEP 4	FUNCTION SWITCH S1 IN 'OHMS C-B' POSITION	ADJUST R17 SO THAT METER INDICATES EXACTLY 100 OHMS.
STEP 5	_____	REPEAT STEPS 3 AND 4 UNTIL NO FURTHER ADJUSTMENT IS REQUIRED TO SATISFY BOTH CONDITIONS; THEN REMOVE THE RESISTOR INSTALLED IN STEP 2, AND PLACE FUNCTION SWITCH S1 IN THE 'OFF' POSITION

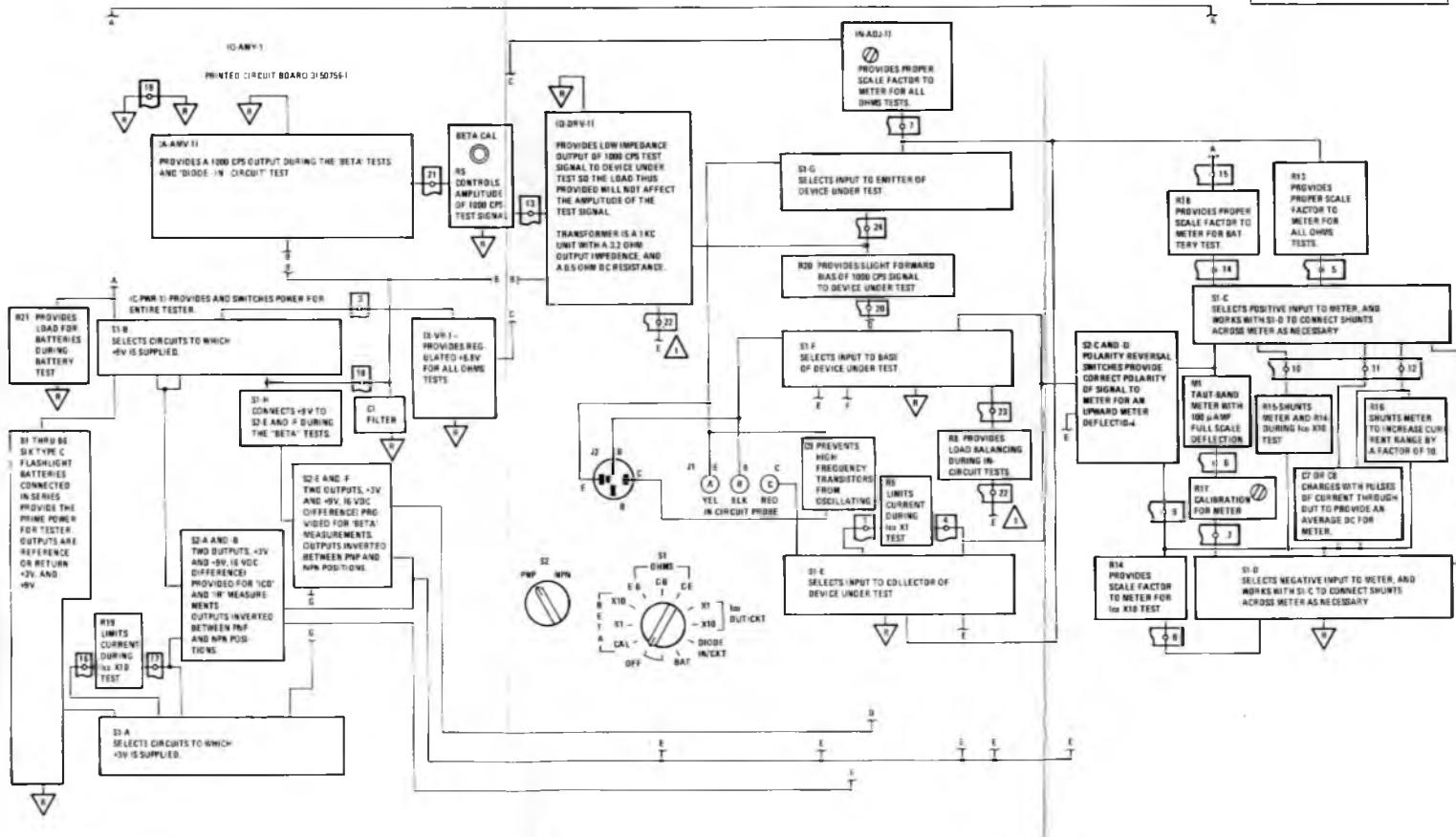
BATTERY REPLACEMENT	
STEP 1	REMOVE THE FOUR (4) SCREWS ON FRONT PANEL.
STEP 2	LIFT OUT FRONT PANEL ASSEMBLY.
STEP 3	REMOVE THE FOUR (4) SCREWS ON BATTERY COVER.
STEP 4	LIFT OUT BATTERY COVER WITH BATTERIES.
STEP 5	EXCHANGE BATTERIES AND RE-ASSEMBLE. (MAINTAIN CORRECT BATTERY POLARITY.)

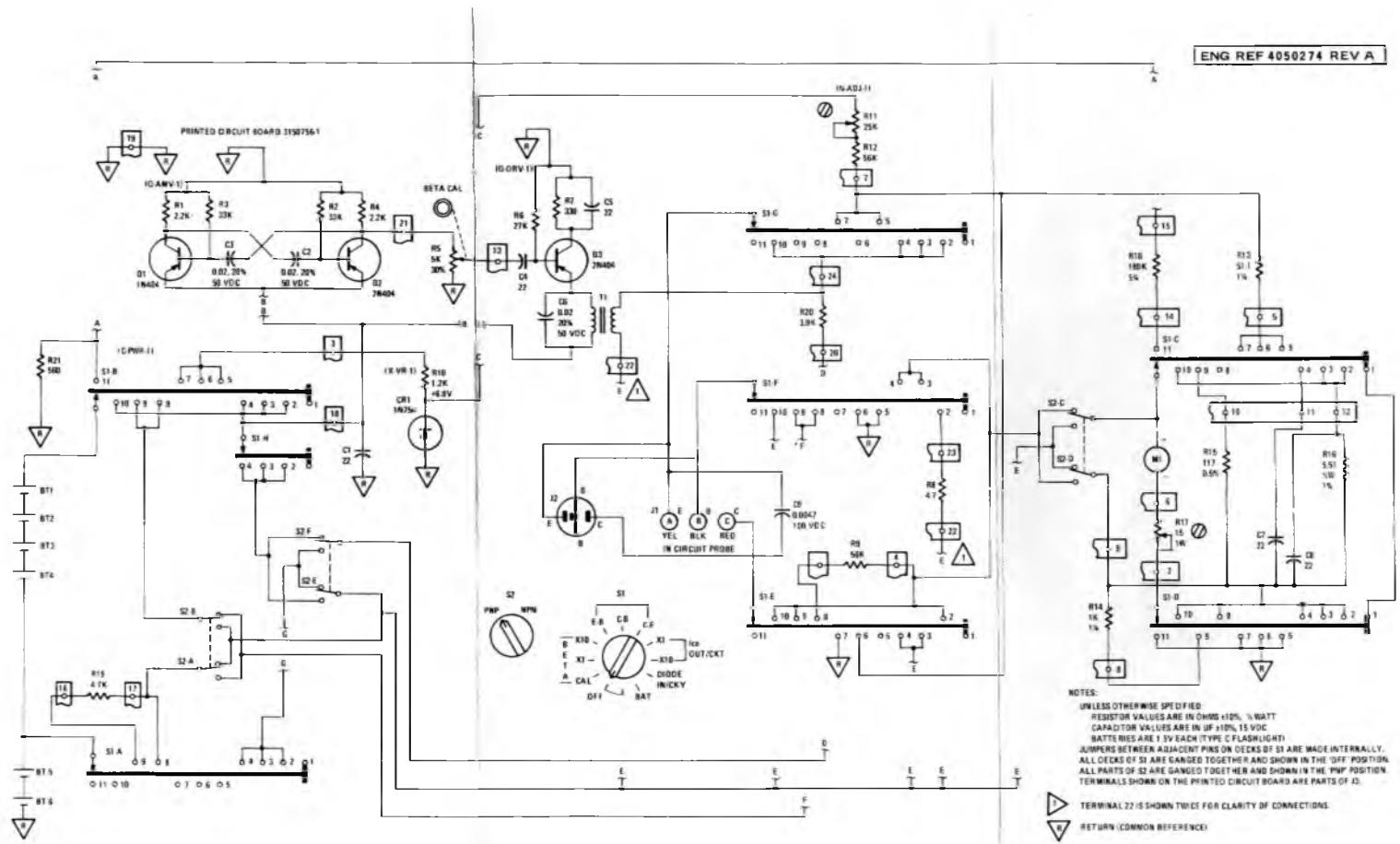


F	G	H	I	J	K	L
2,3,4,5,1,2,3,4,5,1,2,3,4,5,1,2,3,4,5,1,2,3,4,5,1,2,3,4,5,1,2,3,4,5						



REF DESIGN	LOCATION	PART NO.	DESCRIPTION
RT1	H.4/4.3		TYPE C DRYCELL
BT2	B.2/6.1		TYPE C DRYCELL
BT3	C.3/8.1		TYPE C DRYCELL
BT4	C.3/4.3		TYPE C DRYCELL
BT5	D.3/4.3		TYPE C DRYCELL
BT6	D.3/6.1		TYPE C DRYCELL
C1	U.2/4.1	CS12A0220K	CAPACITOR, FXD, T ₀ 22UF, 15 VOC ±10% MIL-C-1885B
C2	G.1/3.4	55C21A2	CAPACITOR, FXD, CER, 02 UF, 50 VOC ±20% SPRAGUE #121A
C3	B.5/3.3	60C21A2	CAPACITOR, FXD, CER, 02 UF, 50 VOC ±20% SPRAGUE #121A
C4	1.2/3.2	CS12A0220K	CAPACITOR, FXD, T ₀ , 22 UF, 15 VOC ±10% MIL C 26659
C5	G.2/3.1	CS12A0220K	CAPACITOR, FXD, T ₀ , 22 UF, 15 VOC ±10% MIL C 26659
C6	F.1/3.1	55C21A2	CAPACITOR, FXD, CER, 02 UF, 50 VOC ±20% SPRAGUE #121A
C7	1.1/4.2	CS12A0220K	CAPACITOR, FXD, T ₀ , 22 UF, 15 VOC ±10% MIL-C-28665
C8	H.3/4.2	CS12A0220K	CAPACITOR, FXD, T ₀ , 22 UF, 15 VOC ±10% MIL-C-28665
C9	F.2/2.3(H)	CK13AX472K	CAPACITOR, FXD, 0047 UF 100 VOC ±10%
CR1	H.2/2.6	1N75A	SEMICOND DEVICE, REF DIODE E2-6.8V ±10% MIL-B-19500/127
J1	K.3/6.4	MS3112EB 38	CONN, ELEC, CIR, MINAT, QUICK DISC 3 CONT MIL-C-28482
J2	K.2/2.3(H)	DS 3313	SOG, TSRT, SUB MIN 4 CONT FURN WITH 55-47202 RING (ELCO CORP)
J3	I.2/4.6	SD6240	RECEPTACLE, CARD, 24 CONTACTS (METHODE)
M1	H.4/2.1	41003931	METER
PCB1	J.1/3.1	31007561	BOARD, PRINTED WIRING
Q1	H.1/3.5	2N404	SEMICONDUCTOR DEVICE TRANSISTOR MILT-19500C
Q2	H.3/3.4	2N404	SEMICONDUCTOR DEVICE TRANSISTOR MILT-19500C
Q3	H.3/3.2	2N404	SEMICONDUCTOR DEVICE TRANSISTOR MILT-19500C
R1	G.1/4.1	RC20GF222K	RESISTOR, FXD, COMP 2.2K, KW, ±10% MIL-R-11
R2	D.2/3.3	RC20GF333K	RESISTOR, FXD, COMP 33K, KW, ±10% MIL-R-12
R3	B.3/3.3	RC200F333K	RESISTOR, FXD, COMP 33K, KW, ±10% MIL-R-11
R4	D.1/2.5	RC200P222K	RESISTOR, FXD, COMP 2.2K, KW, ±10% MIL-R-11
R5	H.5/6.2	21520303	RESISTOR VARIABLE VERNIER 5K
R6	H.4/3.3	RC20GF273K	RESISTOR, FXD, COMP 27K, KW, ±10% MIL-R-11
R7	H.1/3.2	RC20GF331K	RESISTOR, FXD, COMP 33 OHM KW, ±10% MIL-R-11
R8	E.5/4.4	RC20GF477K	RESISTOR, FXD, COMP 4.7 OHM KW, ±10% MIL-R-11
R9	J.4/4.3	RC20GF583K	RESISTOR, FXD, COMP 58K, KW, ±10% MIL-R-11
R10	K.1/4.1	RC200F122K	RESISTOR, FXD, COMP 12K, KW, ±10% MIL-R-11
R11	K.5/3.4	RV6LAYSA253A	RESISTOR, VAR, COMP 25K, KW, ±10% MIL-R-34
R12	J.5/3.1	RC20GF583K	RESISTOR, FXD, COMP 58K, KW, ±10% MIL-R-11
R13	J.4/3.5	RN70B51R1F	RESISTOR, FXD, FILM 81.1 OHM KW, ±1% MIL-R-10609
R14	I.5/4.1	RN70B1001F	RESISTOR, FXD, FILM 10K KW, ±1% MIL-R-10609
R15	I.3/4.1	RN70C1170U	RESISTOR, FXD, FILM 1170 OHM KW, ±1% MIL-R-10609
R16	M.8/4.2	R884CE0R610F	RESISTOR, FXD, WIRE WOUND 6.81 OHM, KW, ±1% MIL-R-93
R17	K.4/4.3	RA10LASM180A	RESISTOR, VAR, WIRE WOUND 18 OHM 1W, ±10% MIL-R-19
R18	H.2/4.2	RC20GF184J	RESISTOR, FXD, COMP 180K, KW, ±5% MIL-R-11
R19	H.1/4.2(H)	RC20GF472K	RESISTOR, FXD, COMP 4.7K, KW, ±10% MIL-R-11
R20	D.2/4.4(H)	RC20GF392K	RESISTOR, FXD, COMP 3.9K, KW, ±10% MIL-R-11
R21	B.1/5.2(H)	RC20GF580	RESISTOR, FXD, COMP 58K OHM KW, ±10% MIL-R-11
S1	O.4/4.5	2142282-1	SWITCH
S2	J.2/6.3	2152283-1	SWITCH
T1	F.2/4.2	34501351	TRANSFORMER, COUPLING





VOLTAGE DATA
TEST CONDITIONS AND EQUIPMENT

1. NO DEVICE UNDER TEST
2. PNP/NPN SWITCH S2 IN PNP POSITION
3. BETA CAL CONTROL R6 FULLY CLOCKWISE
4. FUNCTION SWITCH S1 POSITIONED AS INDICATED
5. TEST INSTRUMENT
D.C. VOLTS: SIMPSON 260
A.C. VOLTS: TEKTHONIX 544 OSCILLOSCOPE OR RMS VOLTMETER HP 410B
6. DC VOLTAGES ARE $\pm 20\%$ AND REFERENCED TO POSITIVE TERMINAL OF BATTERY EXCEPT AS NOTED
7. AC VOLTAGES ARE SQUARE WAVE, 1000 CPS, PEAK TO PEAK, $\pm 20\%$
* REFERENCED TO NEGATIVE TERMINAL OF BATTERY.

VOLTAGE TEST POINTS (ALL VOLTAGES $\pm 20\%$)

TEST POINT	POS. 1 AND 12 OFF	POS. 2 BETA CAL	POS. 3 BETA X1	POS. 4 BETA X10	POS. 5 OHMS E-B	POS. 6 OHMS C-B	POS. 7 OHMS C-E	POS. 8 I _{CO} X1	POS. 9 I _{CO} X10	POS. 10 DIODE IN/CKT	POS. 11 BATT
END OF JACK NEAR R17 J3 PIN 1								-6V	-6V		
J3 PIN 2		-6V	-6V	-6V	9V	-9V	-9V	-8V	-8V		-9V
J3 PIN 3					0V	0V	0V				
J3 PIN 4								-8V	-8V		
J3 PIN 5						-9V	-9V	-9V			
J3 PIN 6		-6V	-6V	-6V	9V	-9V	-9V	6V	8V		-9V
J3 PIN 7						9V	9V	-9V			
J3 PIN 8								-8V	-8V		
J3 PIN 9		-8V	6V	-6V							
J3 PIN 10								-6V	-6V		
J3 PIN 11		0V	-6V	-6V							
J3 PIN 12		6V	6V	-6V							
J3 PIN 13		4V 8 VAC	4V 8 VAC	-4V 8 VAC					4V 8 VAC		
J3 PIN 14											9V
J3 PIN 15											0V
J3 PIN 16								-6V	-6V		
J3 PIN 17								-6V	-6V		
J3 PIN 18		0V	0V	0V							0V
J3 PIN 19		-8V	-8V	-8V							-8V
J3 PIN 20		0V	0V	0V							
J3 PIN 21		-4V 8 VAC	-4V 8 VAC	-4V 8 VAC					-4V 8 VAC		
J3 PIN 22		-8V	-8V	-8V							
J3 PIN 23		6V	-6V	-6V							
END OF JACK NEAR T1. 13 PIN 24			-8V	-8V	-8V						
J3 PIN 22 10 J3 PIN 24			2 VAC	2 VAC	2 VAC						
CR-1 CATHODE	*					+6.8V	+6.8V	+6.8V			
SI-D-11											9V
SI-B-11											0V

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